Title: The Crazy Carnival

Brief Overview:

This lesson introduces expressions and equations and finding the value for an unknown variable. The concept develops the skills necessary to recognize the relationships between the input and output on a function table based on a rule. Students will create and complete function tables. It is expected that students have some background knowledge about numeric patterns and pre-algebra skills. During these lessons, a carnival theme will be used as students solve real problems and increase students' knowledge of expressions, equations, and function tables.

NCTM Content Standard:

Represent and analyze mathematical situations and structures using algebraic symbols.

- Represent the idea of a variable as an unknown quantity using a letter or a symbol
- Express mathematical relationships using equations.

Understand patterns, relations, and functions.

- Represent and analyze patterns and functions, using words, tables, and graphs.

Use mathematical models to represent and understand quantitative relationships.

- Model problem situations with objects and use representations such as graphs, tables, and equations to draw conclusions.

Grade/Level:

Grade 5

Duration/Length:

Three class sessions, approximately 60 minutes per session.

Student Outcomes:

Students will:

- Evaluate expressions with one unknown and one operation.
- Find the unknown in an equation using one operation.
- Complete a one-operation function table for a given situation.
- Create a one-operation function table for a given situation.
- Interpret and write a rule for a one-operation function table.

Materials and Resources:

Day 1

- Student resource "Five in Five"
- *Carlos and the Carnival* by Jan Romero Stevens (one copy, if available)
- *Careless at the Carnival* by Dave Ramsay (one copy, if available)
- Teacher resource "Carnival Images"
- Student resource "Crazy Carnival"
- Student resource "Vocabulary Match" (prepare one class set)
- Teacher resource "Vocabulary Cards"
- Teacher resource "Expressions"
- Student resource "Carnival Foods"
- Centimeter or Connecting Cubes
- Student resource "Balancing Act"

Day 2

- Teacher resource "Fortune Teller"
- Calculators for each student
- Student resource "Carnival Rides"
- Student resource "Crazy Carnival"
- Teacher resource "Ticket Sales"
- Student resource "Ticket Sales Function Table"
- Student resource "Horse Race"
- Teacher resource "Rule Cards/Digit Cards" (prepare several sets in advance)
- Chart paper
- Student resource "Carnival Games"

Day 3

- Student resource "Fun House Functions"
- Student resource "Function Concentration Rules"
- Student resource "Function Concentration Cards" (prepare a class set)
- Teacher resource "Balloon Pop"
- Student resource "Games, Games, Games"
- Poster paper
- Crayons or markers
- Access to the internet, if available
- Student resource "Summative Assessment"

Development/Procedures:

Day 1
Pre-assessment

- Allow students five minutes to work with partners or in small groups to complete student resource, "Five in Five." Students will brainstorm to determine background knowledge about functions and function tables and create quick responses to the five questions. An answer key is provided.
- Facilitate a brief discussion to gain an understanding of student's prior knowledge.

Engagement

- Begin a discussion about carnivals. Ask students to share what they know about carnivals. If available, read an excerpt from a carnival-themed children's book such as *Carlos and the Carnival*, by Jan Romero Stevens or *Careless at the Carnival*, by Dave Ramsey.

  You can also present a visual of carnival images to illicit discussion, if necessary. Use teacher resource "Carnival Images" if needed.

- Display and/or distribute student resource "Crazy Carnival" and tell students that the carnival is gearing up to come to town. Say: "Over the next few days we will be using the carnival theme to solve mathematical and real-world problems involving patterns and relationships using expressions, equations and function tables. Get ready to have lots of fun!"

Exploration

- Ask: "When someone mentions the expression on your face, what does that make you think about?" Answers will vary. Lead students to the conclusion that a facial expression is a way to show a feeling.

- Say: "Today, we are going to learn about expressions in math." Ask students to brainstorm ideas about the mathematical meaning of the word, expression. They can jot their ideas down on a dry erase board. Some students will discuss the use of variables and that there are parts of an expression that can be unknown, while some students may not be able to draw any conclusions at this point.

- Distribute, student resource "Vocabulary Match" to pairs of students. Prepare this matching game ahead of time. Duplicate the student resource and cut apart the squares to make a class set.

- Allow students to work with their partner for two minutes to attempt to match vocabulary words with definitions. After two minutes, stop. It is helpful to use a visual timer to help keep students on track. An answer key is provided.

Explanation

- Clarify vocabulary meanings using teacher resource "Vocabulary Cards." Emphasize the meanings for *expression* and *variable* as these will be referred to often throughout the unit. *Evaluate, Value, and Substitute* simply require understanding of the synonymous language. Note that it is important to use the vocabulary consistently throughout the unit.

- Provide examples of one-variable algebraic expressions and work through them with students as guided practice. Allow for changing the value of each variable. Examples:

$3 + a$	*for a = 3, 8, 13, etc.*
$c \div 4$	*for c = 8, 12,16, etc.*
$8 - n$	*for n = 2,4,5, etc.*
$11 \cdot q$	*for q = 2,4,6, etc.*

- Use the following steps:
  1. Copy the expression *3 + a*
  2. Substitute the value for the variable *3 +3*
  3. Simplify *6*

- Provide examples of word problems with an unknown that gets replaced with a variable. Use teacher resource "Expressions."

> *All of the kids in the neighborhood are planning to attend the Crazy Carnival on Saturday afternoon. There are 7 more girls than boys in the neighborhood. Write an expression to show how many girls will attend the Crazy Carnival.*
>
> **Think Aloud: I know that the number of girls is 7 more than the number of boys. The number of boys is my unknown. Therefore, I will use *b* as my variable. *b + 7 will help me determine how many girls will attend the carnival on Saturday.***

- Provide several more examples, using teacher resource "Expressions." Be sure to address all operations (+, -, x, ÷) Additional examples can be used.

- Provide a few more examples of expressions if necessary and/or if time allows. Students can use dry-erase boards to display their responses.

Application

- Provide time for students to complete the student resource, "Carnival Foods." This will include examples of writing and evaluating expressions and solving equations. An answer key is provided.
- Circulate and make anecdotal records to evaluate students' understanding.
- If students still need to practice, distribute dry erase boards and have them evaluate expressions.

Differentiation

Reteach

For struggling students, use a concrete example by providing centimeter cubes or a similar manipulative to substitute for the variable in a variety of expressions.

Enrich

- Allow students who acquire the skill quickly an opportunity to create their own carnival type word problems containing an unknown variable. Use teacher resource "Expressions" as a model. They can trade and solve with a partner.

Assessment

- Have students complete student resource "Balancing Act." This will demonstrate understanding of the concepts of expressions and equations. An answer key is provided.

Day 2
Engagement

- Use teacher resource "Fortune Teller" to play a number game.
- Hand out calculators for ease of computation.
- Create a transparency for students to visually see the steps if needed.

This number game is based on "Happy Birthday" from Mathemagic in the Classroom, Sherard, Wade "Happy Birthday" *Mathemagic in the Classroom, Revised* (1998) pp 11-12.

ISBN: 0-8251-3818-3
J Weston Walch, Publisher
PO Box 658
Portland, Maine 04104-0658

Exploration

- Pose the following scenario to your students:

> *"The Crazy Carnival comes to your town every year and they want everyone to have fun. Even though you have to use money to buy your tickets for rides, games, food and prizes, the owners of the Crazy Carnival allow you to save your left-over tickets from year to year so that you can get a head start on the fun before you have to spend any more money! Isn't that generous? They also want to teach you to be responsible, which **IS** a very good skill, after all! You are always so excited when the Crazy Carnival comes to town, so every year you make sure to be responsible and safely stash some leftover tickets in your underwear drawer! After all, who would find them there? After you see the Crazy Carnival flyer posted at your school, you race home to count those leftover tickets!"*

- Distribute student resource "Carnival Rides."
- Ask students to look at the data and complete the function table.
- Allow students time to answer the three questions and discuss the answers with their partners. They should be recognizing the relationship between how many rides they can take for a given number of tickets.
- Circulate to make anecdotal records about student understanding. An answer key is provided.

Explanation

- Ask some students to share their responses from the Exploration with the class.
- Be sure to ask students to justify their responses by asking questions such as: "How did you reach that conclusion? How could you prove that? What was the rule?"
- Review question three on student resource "Carnival Rides." Make the connection with the students that they will need to buy more tickets for the carnival. Refer students back to student resource "Crazy Carnival" to determine the cost for tickets at the carnival this year (Four tickets cost one dollar.).

- Ask: “If four tickets cost one dollar, how could we display that?” Accept various responses.
- Use teacher resource “Ticket Sales” as a visual to illustrate the purpose of a function table. Explain to students that they can use their ticket data to create a function table. Discuss the purpose of a function and create a working definition for the term, function table. Ex: A table that shows pairs of numbers that follow a rule.
- Lead students to transfer data from “Ticket Sales” onto a function table. Use student resource “Ticket Sales Function Table.”
- Discuss the rule for the function table and emphasize that all function tables follow one rule.
- Discuss the use of variables.
- Model student resource “Horse Race Game.”
- Prior to playing the “Horse Race Game”, have students create a blank fucntion table. If necessary provide a pre-made function table.
- To modify the game, the Horse Race board can be lengthened or shortened.

Application (Students apply/practice the learning.)

- Have students play the game, student resources, “Horse Race” to create and complete their function tables with a partner or small group.
- Directions for the game are included in the student resources.

Differentiation

Re-teach

- Use the teacher resource, “Rule Cards/Digit Cards” to work through different examples with students who are struggling. **Teacher Tip**: Prior to use, make and cut apart several copies of each set of cards. You will need more than one set of digit cards to allow for multiple use of the same number and/or double digit numbers.
- Give students a rule and an input and have them determine the output.
- If necessary, draw a T-chart on large paper to simulate the function table.
- Repeat as needed.

Enrich

- Have partners create function tables to represent different things at a carnival that a function table would be useful for.

Assessment

- Have students independently complete student resource “Carnival Games” to be collected and graded. An answer key is provided.

Day 3

Engagement

- Provide time for students to work with a partner to explore student resource "Fun House Functions." An answer key is provided.

Exploration

- Allow students time to play Function Concentration. Provide each student pair with one copy of student resource "Function Concentration Rules" and one set of card sets prepared from teacher resource "Function Concentration Cards." Teacher Tip**:** Prepare Function Concentration Game cards ahead of time by running the equation cards on one colored sheet of paper and the function table cards on a different color. If possible, laminate and store in sets to preserve for future use.

- Circulate to make anecdotal records concerning student understanding.

Explanation

- After allowing students adequate time to play the game, ask: "What strategy (ies) did you use to make your matches in the Function Concentration Game? How did you know which rule matched each function table? How did our lesson yesterday help you when you played the Function Concentration Game today?"
- Guide students through a review of the process for using the rule to determine the input/output on a function table.
- Use the matched results from the Concentration game to guide students to discover the relationships between inputs and outputs. For example, when the output is greater than the input, the rule MUST be an addition or multiplication operation. Likewise, when the output is less than the input, the operation must be subtraction or division. This will allow students to eliminate unreasonable responses.
- Use teacher resource "Balloon Pop" as guided practice being sure to continue the discussion about reasonable operations. An answer key is provided.

Application

- Review directions with students for the activity on student resource "Games, Games, Games." Pre-cut the cards and have them ready to distribute to small groups.
- Review the directions with the students.
    - Each group will choose one game and one function table from the pile.
    - You will have 15 minutes to create a poster to advertise your game at the carnival
    - Your poster must include your function table as a way to display the (imaginary) results for your game.
    - It is your job to find the rule. Write the rule on the back of your poster.
    - If necessary provide a model poster

- Allow time for students to create the poster to advertise their carnival game and relate their function table to their game (Ex: points won, prizes earned, identify the rule of the function).

- Using a Gallery Walk technique, students will view classmates posters in order to interpret the rules for each function table.

Differentiation

Reteach

Visit any one of the following websites with students who need extra support. It is helpful to create a document with the web addresses already written, so that students can click on the link. Browse each site prior to meeting with students to determine which is more preferred.

http://teams.lacoe.edu/documentation/classrooms/amy/algebra/3-4/activities/functionmachine/functionmachine3_4.html

http://www.mathplayground.com/FunctionMachine.html

Enrich

Have students create a function table using a rule of their choice. Students can then switch function tables with a partner to try to determine the rule.

Summative Assessment:

- Students will independently complete, student resource "Summative Assessment" to demonstrate their learning. This assessment will encompass all skills taught over the three days. An answer key is provided.

Authors:

Jennifer Connolly
Joppa View Elementary School
Baltimore County Public Schools

Shannon Scott
Templeton Elementary School
Prince Georges County Public Schools

Name _____

Five in Five Pre-assessment

1. Evaluate this expression when $r = 3$.

   $36 \div r$

2. Find the value of g when $x = 9$.

   $x \cdot 5 = g$

3. Complete the function table

Input *(x)*	Output *(y)*
9	27
11	33
	36
15	

4. What is the rule for this function table?

5. What is the relationship between input (x) and output (y) on a function table?

Name _____

Five in Five Pre-assessment

1. Evaluate this expression when $r = 3$.

   $36 \div r$

2. Find the value of g when $x = 9$.

   $x \cdot 5 = g$

3. Complete the function table

Input *(x)*	Output *(y)*
9	27
11	33
	36
15	

4. What is the rule for this function table?

5. What is the relationship between input (x) and output (y) on a function table?

Answer Key:

1.Evaluate this expression when $r = 3$.

$36 \div 3$

2. Find the value of g when $x = 9$.

$9 \cdot 5 = 45$

3. Complete the function table

Input *(x)*	Output *(y)*
9	27
11	33
12	36
15	45

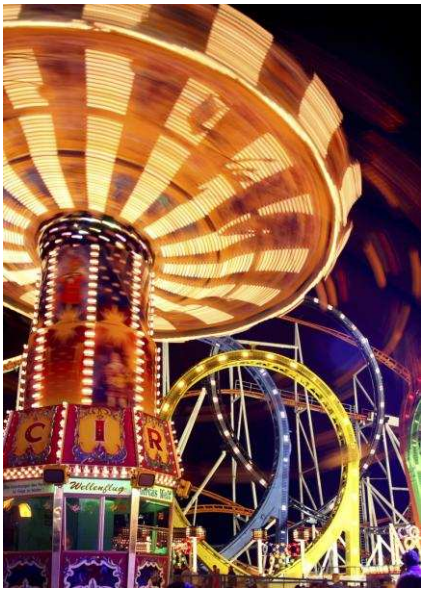
4. What is the rule for this function table?

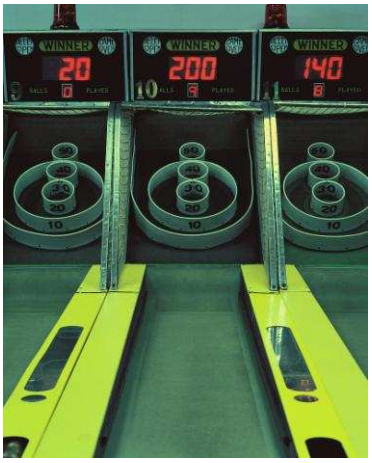
Rule: Multiply by 3

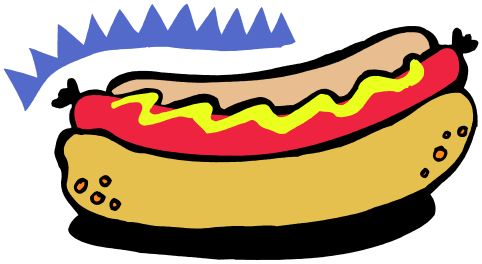
5. What is the relationship between input (x) and output (y) on a function table?

Numbers in the input are multiplied by 3.

Carnival Images







Crazy Carnival

Coming Next Week to Your Hometown!

Fun Games

Fast Rides

Delicious Food

Fantastic Prizes

Buys You 4 Tickets!

Vocabulary Match

Evaluate	Expression
Substitute	To find the value of an expression
Variable	A letter used to represent an unknown value.
A variable or combination of variables, numbers, and/or operational symbols that represent a mathematical relationship.	To trade.

Answer Key

Evaluate To find the value of an expression	Expression A variable or combination of variables, numbers, and/or operational symbols that represent a mathematical relationship.
Substitute To trade.	
Variable A letter used to represent an unknown value	.

Vocabulary Cards

Evaluate

To find the value of a math expression.

Substitute

To trade.

Variable

A symbol that can be replaced by a number in an expression or equation.

Expression

A variable or combination of variables, numbers, and operation symbols that represent a mathematical relationship.

Equation

A mathematical sentence with an equal sign. The amount of one side of the equal sign has the same value as the amount on the other side.

Expressions

All of the kids in the neighborhood are planning to attend the Crazy Carnival on Saturday afternoon. There are 7 more girls than boys in the neighborhood. Write an expression to show how many girls will attend the Crazy Carnival.

There are twice as many rides at the Crazy Carnival than there are games. Write an expression to represent the number of rides there are.

On the last day, the Crazy Carnival closes down three hours early because of a thunder and lightning storm. Write an expression to represent how much earlier the carnival had to close.

Frankie shares his carnival tickets evenly with his two sisters. Write an expression to represent how many tickets each child will have.

Expressions

All of the kids in the neighborhood are planning to attend the Crazy Carnival on Saturday afternoon. There are 7 more girls than boys in the neighborhood. Write an expression to show how many girls will attend the Crazy Carnival.

(Answer: b + 7)

There are twice as many rides at the Crazy Carnival than there are games. Write an expression to represent the number of rides there are.

(Answer: 2 • g/2g/2 x g)

On the last day, the Crazy Carnival closes down three hours early because of a thunder and lightning storm. Write an expression to represent how much earlier the carnival had to close.

(Answer: c – 3)

Frankie shares his carnival tickets evenly with his two sisters. Write an expression to represent how many tickets each child will have.

(Answer: f ÷3)

Carnival Food

1. You are really hungry at the Carnival and you bought 10 hotdogs, but you were only able to eat *w* hot dogs. Write an expression to represent how many hot dogs you did not eat.

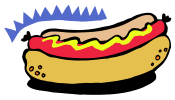
2. In a french fry eating contest you were able to eat three times as many French fries as your friend. Write an expression to represent how many French fries you ate.

3. At LuLu's Lemonade Stand, a glass of lemonade costs $2. Write an expression that represents the cost of *x* glasses of lemonade.

4. On Wednesday at the Crazy Carnival they are giving away free cotton candy! At the beginning of the day the Carnival had 34 bags of cottom candy. If they gave away *z* bags of cotton candy, write an expression that represents how many bags of cotton candy they had at the end of the day.

Snack Variables

w= hotdog



x= lemonade

y= french fries

z=cotton candy

Carnival Food

Answer Key:

1. You are really hungry at the Carnival and you bought 10 hotdogs, but you were only able to eat *w* hot dogs. Write an expression to represent how many hot dogs you did not eat.

   $10 - w$

2. In a French fry eating contest you were able to eat three times as many French fries as your friend. Write an expression to represent how many French fries you ate.

   $y \cdot 3$

3. At LuLu's Lemonade Stand, a glass of lemonade costs $2. Write an expression that represents the cost of *x* glasses of lemonade.

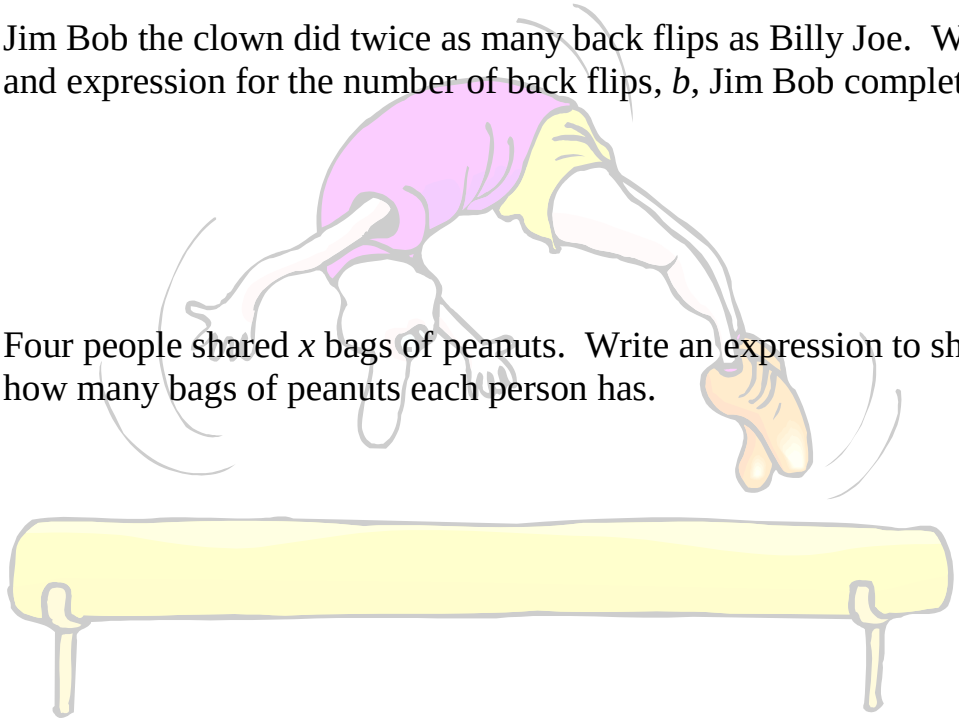
   $2 \cdot x$

4. On Wednesday at the Crazy Carnival they are giving away free cotton candy! If the Carnival gave away *z* bags of cotton candy and there are 34 bags left. Write an expression that represents how many bags of cotton candy they had when the day began.

   $34 + z$

A Balancing Act

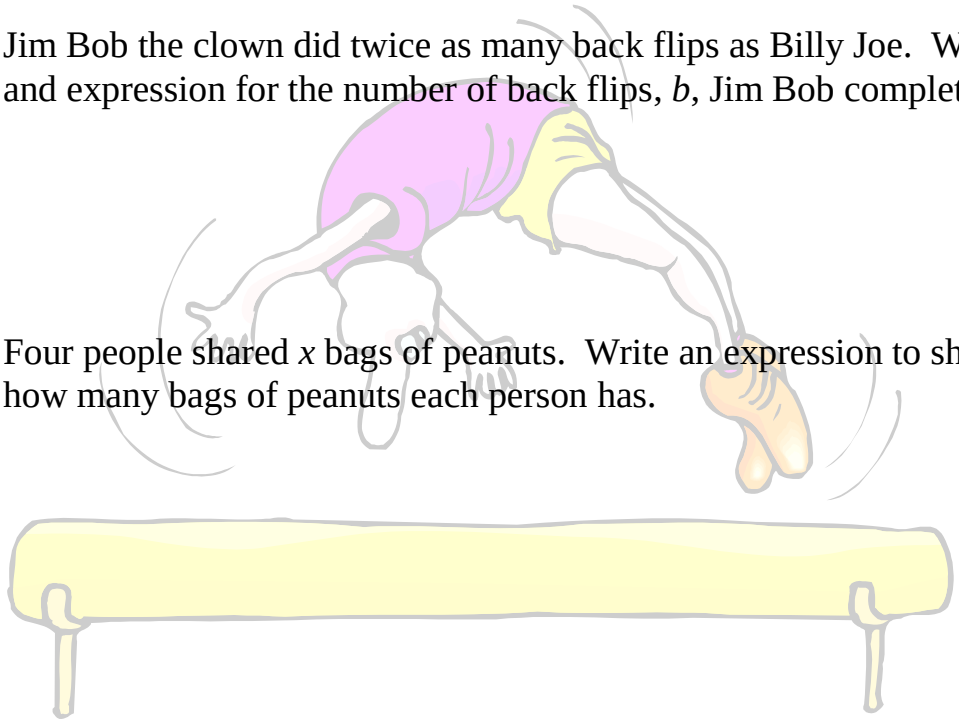
1. Jim Bob the clown did twice as many back flips as Billy Joe. Write and expression for the number of back flips, *b*, Jim Bob completed.



2. Four people shared *x* bags of peanuts. Write an expression to show how many bags of peanuts each person has.

A Balancing Act

1. Jim Bob the clown did twice as many back flips as Billy Joe. Write and expression for the number of back flips, *b*, Jim Bob completed.



2. Four people shared *x* bags of peanuts. Write an expression to show how many bags of peanuts each person has.

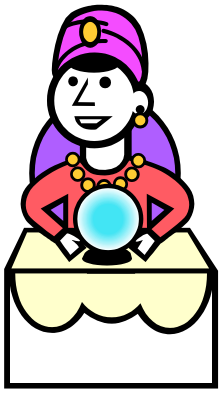
A Balancing Act Answer Key

1. Jim Bob the clown did twice as many back flips as Billy Joe. Write and expression for the number of back flips, *b*, Jim Bob completed.

   $b \cdot 2$

2. Four people shared *x* bags of peanuts. Write an expression to show many bags of peanuts each person gets.

   $x \div 4$



Fortune Teller

Come one, come all! Challenge the Fortune Teller to guess your birthday!

Use your calculator to follow the steps. Watch and see how the Fortune Teller can tell you your birthday! It's Math Magic!

1. Multiply the number of the month of your birth by 4.
2. Add 9 to the product.
3. Multiply the sum by 5.
4. Add 20 to the product.
5. Multiply the sum by 5
6. Add the day of the month of your birth to the product.
7. Be prepared to ask the Fortune Teller to tell you your final answer!

Notes for the “Fortune Teller” to remember:

Secret of the Trick:

- Subtract 325 from the final answer. Group the digits of the resulting number in pairs from right to left.

_____ _____ _____ _____
(month) (day)

- The number in the ten’s and the one’s places is the day of birth, and the number in the thousand’s and the hundred’s places is the month of birth.

Fortune Teller game is adapted from *Mathemagic in the Classroom*.

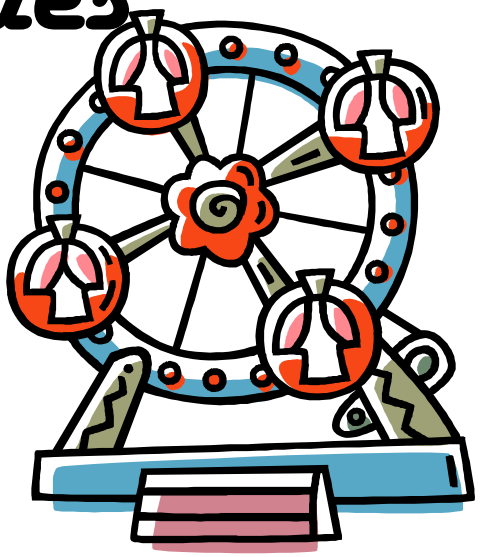
Sherard, Wade “Happy Birthday” *Mathemagic in the Classroom, Revised* (1998) pp 11-12.

ISBN: 0-8251-3818-3
J Weston Walch, Publisher
PO Box 658
Portland, Maine 04104-0658

Carnival Rides

Rule: Multiply by 3

Rides *(r)*	Tickets *(t)*
1	3
2	
3	9
	12
5	15



1. You have 12 tickets left over from last year's Crazy Carnival. How many rides can you take before you have to buy more tickets?

2. If your big brother gives you 12 more tickets, how many rides can you ride now?

3. What equation represents the rule of this function table?
   - ⓐ $3 + r = t$
   - ⓑ $3 \cdot r = t$
   - ⓒ $3 \cdot t = r$
   - ⓓ $1 + t = r$

4. Your mom says that you can go on 10 rides today. How many tickets will you need?

   Do you now need to buy more tickets? Explain.

Carnival Rides Answer Key

Rides *(r)*	Tickets *(t)*
1	3
2	6
3	9
4	12
5	15
6	18
7	21
8	24

1. You have 12 tickets left over from last year's Crazy Carnival. How many rides can you take before you have to buy more tickets? 4 rides

2. If your big brother gives you 12 more tickets, how many rides can you ride now? 8 rides

3. What equation represents the rule of this function table?

ⓑ $3 \cdot r = t$

4. Your mom says that you can go on 10 rides today. How many tickets will you need? 30 tickets

Do you now need to buy more tickets? Explain.

Yes. Answers will vary.

Ticket Sales

$1		4 Tickets
$2		

Name _____

Ticket Sales Function Table

Rule: Multiply by 4

Cost *(c)*	Number of Tickets *(t)*

Name _____

Ticket Sales Function Table

Rule: Multiply by 4

Cost *(c)*	Number of Tickets *(t)*

Horse Race

Players: 2-4

Skill: This game provides practice with creating and completing a one-operation function table.

Materials:

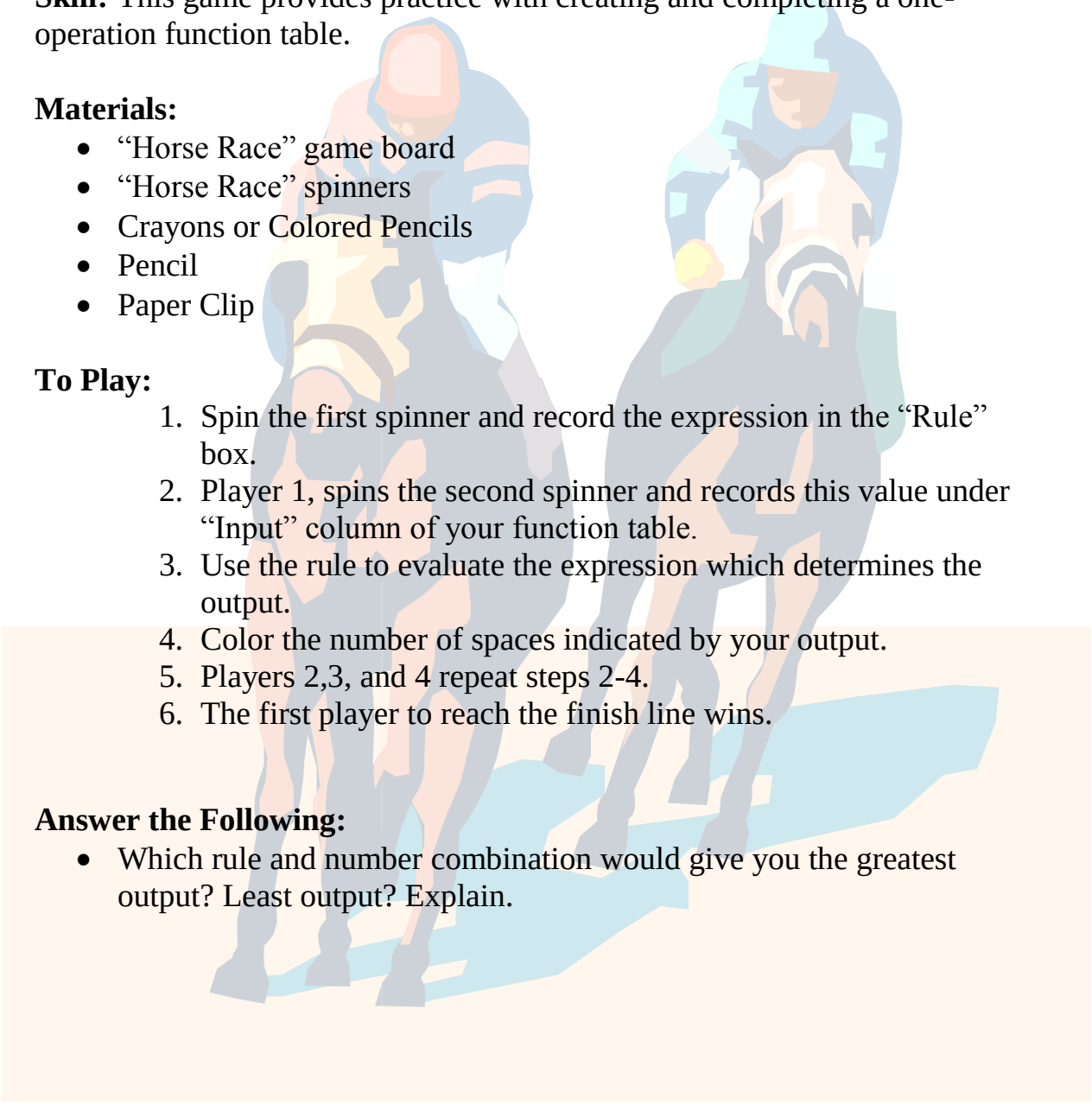
- "Horse Race" game board
- "Horse Race" spinners
- Crayons or Colored Pencils
- Pencil
- Paper Clip

To Play:

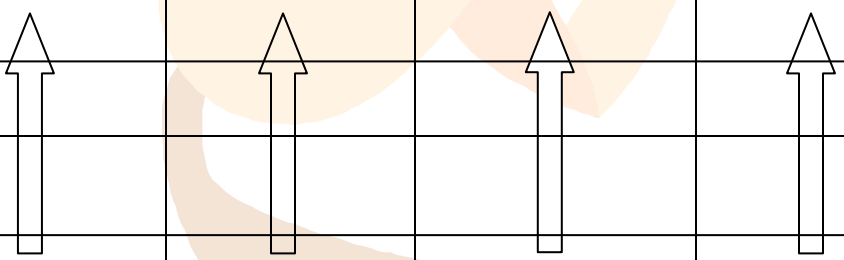
1. Spin the first spinner and record the expression in the "Rule" box.
2. Player 1, spins the second spinner and records this value under "Input" column of your function table.
3. Use the rule to evaluate the expression which determines the output.
4. Color the number of spaces indicated by your output.
5. Players 2,3, and 4 repeat steps 2-4.
6. The first player to reach the finish line wins.

Answer the Following:

- Which rule and number combination would give you the greatest output? Least output? Explain.

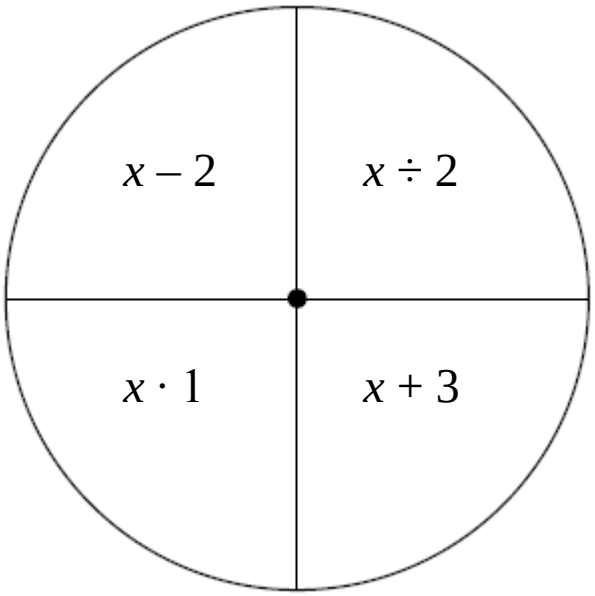


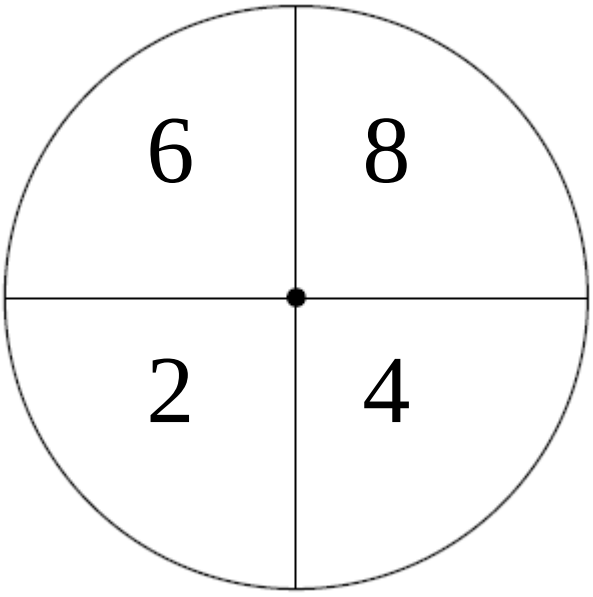
FINISH LINE



1	2	3	4

Horse Race Spinners





Rule Cards/Digit Cards

Rule: $x + 3$	Rule: $x - 1$
Rule: $x \cdot 5$	Rule: $x + 10$
Rule: $x \div 3$	Rule: $x + 2$
Rule: $x + 5$	Rule: $x \cdot 3$
Rule: $x + 4$	Rule: $x \cdot 2$

Rule Cards/Digit Cards

1	2	3
4	5	6
7	8	9
	0	

Name _____

Carnival Games

Rule: Multiply by 5

Games *(g)*	Tickets *(t)*
2	
3	15
4	20
6	30

5. Complete the function table.

6. What equation represents the rule of this function table?
   - ⓐ g x 5 = t
   - ⓑ g + 5 = t
   - ⓒ 2 x t = g
   - ⓓ 5 + t = g

Carnival Games Answer Key

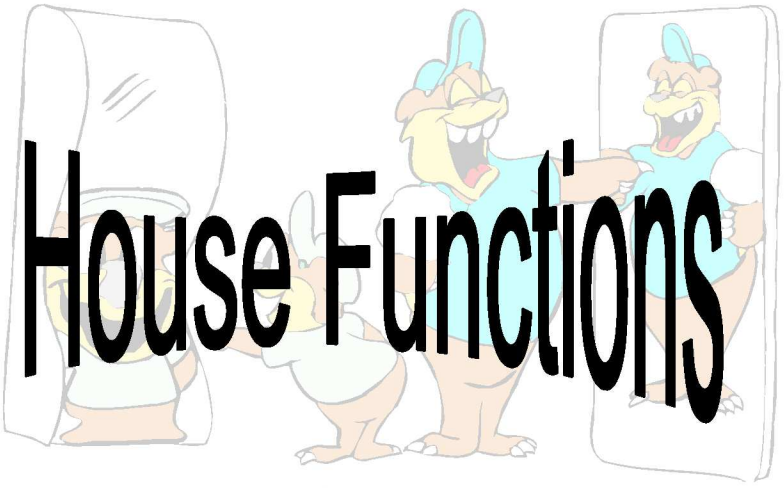
7.

Games *(g)*	Tickets *(t)*
2	10
3	15
4	20
5	25
6	30
7	35

2. What equation represents the rule of this function table?

ⓐ g x 5 = t

Fun House Functions



What function is represented by the  **?**

Look at the following examples.

6  **2 = 3**

10  **2 = 5**

Solve the following equations.

8  **4 =**

42  **3 =**

15  **5 =**

100  **20 =**

Fill in different numbers for each.

_____  _____ **= 4**

_____  _____ **= 4**

_____  _____ **= 4**

Fun House Functions Answer Key

Answers are from left to right.

1. 2
2. 14
3. 3
4. 5
5. 12 ÷ 3
6. 4 ÷ 1
7. 16 ÷ 4

$y = x - 1$	$y = x - 0$	$y = x$
$y = x + 1$	$y = x + 2$	$y = x + 3$
$y = 5x$	$y = 2x$	$y = 10x$
$y = x \div 3$	$y = 2x + 1$	$y = x \div 2$

Input (x)	Output (y)
1	10
2	20
3	30

Input (x)	Output (y)
1	5
2	10
3	15

Input (x)	Output (y)
1	1
2	2
3	3

Input (x)	Output (y)
2	1
4	2
6	3

Input (x)	Output (y)
1	1
2	2
3	3

Input (x)	Output (y)
1	3
2	4
3	5

Input (x)	Output (y)
1	2
2	4
3	6

Input (x)	Output (y)
1	4
2	5
3	6

Input (x)	Output (y)
6	2
9	3
12	4

Input (x)	Output (y)
1	3
2	5
3	7

Input (x)	Output (y)
1	2
2	3
3	4

Input (x)	Output (y)
1	0
2	1
3	2

Rules for Function Concentration

1. Shuffle the cards and place them face down on the table. The game should be played in pairs.

2. Players take turns flipping over two cards at a time, trying to make a match. A match consists of matching an input-output table card and the corresponding algebraic equation card that represents the relationship between each input and output in the table.
   For example, $\boldsymbol{y = x + 1}$ is a match for the table below:

Input (x)	**Output (y)**
1	**2**
2	**3**
3	**4**

3. If a player gets a match, she/he can try again. If not, it is the next player's turn.

4. The game ends when all cards have been matched.
   The player with the most matches wins.

Rules for Function Concentration

1. Shuffle the cards and place them face down on the table. The game should be played in pairs.

2. Players take turns flipping over two cards at a time, trying to make a match. A match consists of matching an input-output table card and the corresponding algebraic equation card that represents the relationship between each input and output in the table.
   For example, $\boldsymbol{y = x + 1}$ is a match for the table below:

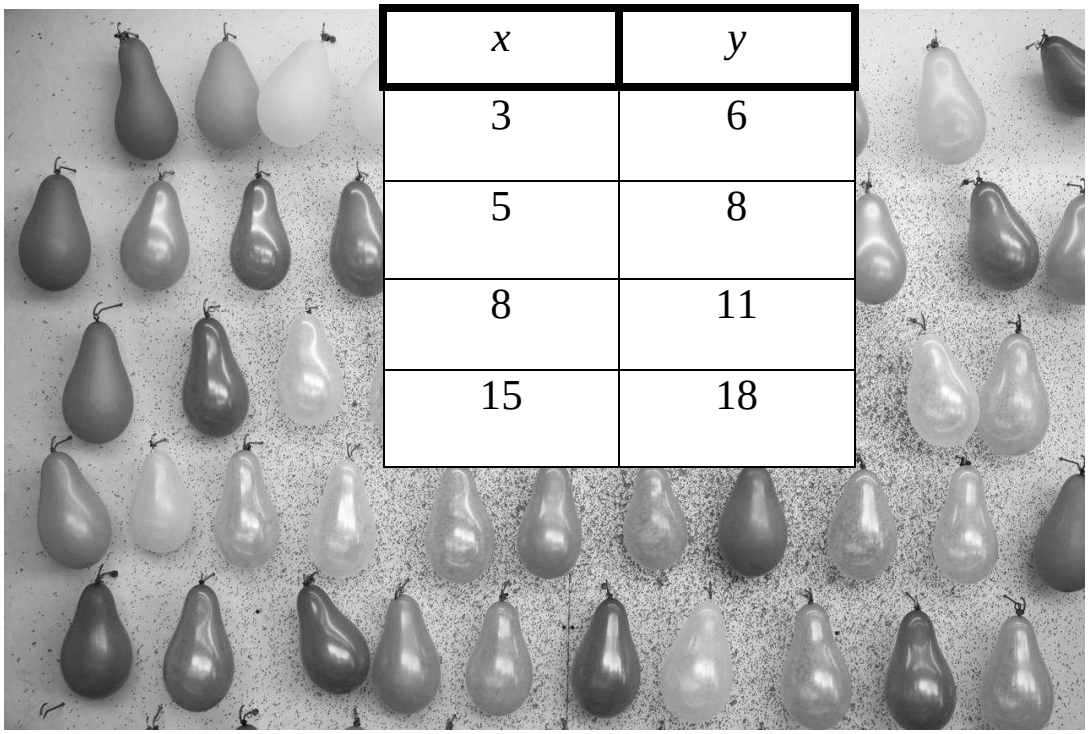
Input (x)	**Output (y)**
1	**2**
2	**3**
3	**4**

3. If a player gets a match, she/he can try again. If not, it is the next player's turn.

4. The game ends when all cards have been matched.
   The player with the most matches wins.

Name _____

Balloon Pop



x	*y*
3	6
5	8
8	11
15	18

1. You are watching a friend play the Balloon Pop game. For each balloon *(x)* that he pops he earns points *(y)*. What is the rule for this game? Explain your thinking.

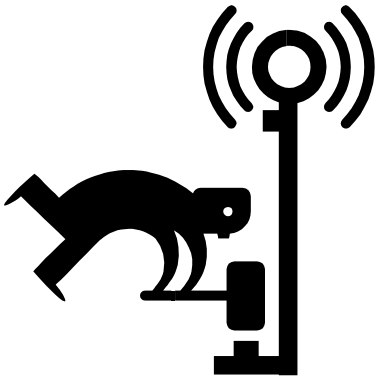
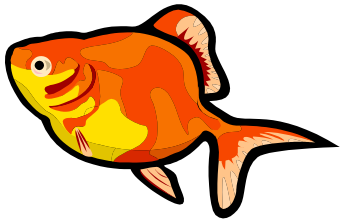
x	*y*
2	12
6	36
8	48
11	66

2. The rules for Balloon Pop changed. What is the new rule? Explain.

Balloon Pop Answer Key

1. Rule: Add 3
2. Rule: Multiply by 6

Games, Games, Games

Skee-Ball 	Strong Student 
Bottle Toss 	Go Fish 
Dart Throw 	Rubber Duck Dive 

Games, Games, Games

x	*y*
1	4
2	5
6	9
7	10
8	11
10	13

x	*y*
1	0
5	4
8	7
9	8
10	9
11	10

x	*y*
1	2
2	4
3	6
7	14
10	20
11	22

x	*y*
3	13
4	14
5	15
9	18
10	20
20	30

x	*y*
8	2
24	6
36	9
40	10
44	11
56	14

x	*y*
5	1
15	3
20	4
30	6
35	7
40	8

Name _____

Summative Assessment

1. Data from ticket sales at the carnival was used to create this function table.

Function Table

x	*y*
2	12
4	24
6	36
8	48

Which of these expressions correctly describe the relationship between *x* and *y* ?

ⓐ divide by 3
ⓑ divide by 2
ⓒ multiply by 6
ⓓ add 12

2. Maria and Rosa both love the Tilt-A-Whirl. Rosa rode the Tilt-A-Whirl three more times than Maria. Which expression represents the number of times that Rosa rode the Tilt-A-Whirl? Let *x* represent the number of times that Maria rode the Tilt-A-Whirl.

ⓐ $x \cdot 3$
ⓑ $x \div 3$
ⓒ $x - 3$
ⓓ $x + 3$

3. Laurie spilled lemonade on her Fun House score card. Please help her to fill in the missing numbers. Complete the function table below.

Rule: Subtract 4

x	*y*
4	
10	6
	9
25	

Answer Key

Summative Assessment

1. Data from ticket sales at the carnival was used to create this function table.

Function Table

x	*y*
2	12
4	24
6	36
8	48

Which of these expressions correctly describe the relationship between *x* and *y* ?

ⓒ multiply by 6

2. Maria and Rosa both love the Tilt-A-Whirl. Rosa rode the Tilt-A-Whirl three more times than Maria. Which expression represents the number of times that Rosa rode the Tilt-A-Whirl? Let *x* represent the number of times that Maria rode the Tilt-A-Whirl.

ⓓ $x + 3$

3. Laurie spilled lemonade on her Fun House score card. Please help her to fill in the missing numbers. Complete the function table below.

Rule: Subtract 4

x	*y*
4	0
10	6
13	9
25	21

Extended Constructed Response

This table represents the relationship between the number of tickets you have and the number of teddy bears you can buy.

Tickets	*Teddy Bears*
6	1
18	3
30	5
42	7

Part A

What is the rule for the table?

_____

Part B

- Explain why your answer is correct. Use what you know about function tables in your explanation. Use words, numbers, and/ or symbols in your explanation.

- Suppose on Friday the Carnival is trying to get rid of the remaining Teddy bears. If you have 6 tickets you can get 3 Teddy bears and 18 tickets will buy you 9 Teddy bears. How will the rule for the function table change? Explain why your answer is correct. Use what you know about function tables in your explanation. Use words, numbers, and/or symbols in your explanation.

_____

_____

_____

_____

_____

Answer Key

This table represents the relationship between the number of tickets you have and the number of teddy bears you can buy.

Tickets	*Teddy Bears*
6	1
18	3
30	5
42	7

Part A

What is the rule for the table?

Rule: Divide by 6

_____

Part B

- Explain why your answer is correct. Use what you know about function tables in your explanation. Use words, numbers, and/ or symbols in your explanation.

- Suppose on Friday the Carnival is trying to get rid of the remaining Teddy bears. If you have 6 tickets you can get 3 Teddy bears and 18 tickets will buy you 9 Teddy bears. How has the rule for the function table changed? Explain why your answer is correct. Use what you know about function tables in your explanation. Use words, numbers, and/or symbols in your explanation.

Answers will vary.

Bullet #2: The new rule: divide by 2